

Review Article

Phytoremediation of Nitrogen as Green Chemistry for Wastewater Treatment System

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Received 27 February 2017; Accepted 2 May 2017; Published 30 May 2017

Academic Editor: Donald L. Feke

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It is noteworthy that ammoniacal nitrogen contamination in wastewater has reportedly posed a great threat to the environment. Although there are several conventional technologies being employed to remediate ammoniacal nitrogen contamination in wastewater, they are not sustainable and cost-effective. Along this line, the present study aims to highlight the significance of green chemistry characteristics of phytoremediation in nitrogen for wastewater treatment. Notably, ammoniacal nitrogen can be found in many types of sources and it brings harmful effects to the environment. Hence, the present study also reviews the phytoremediation of nitrogen and describes its green chemistry characteristics. Additionally, the different types of wastewater contaminants and their effects on phytoremediation and the phytoremediation consideration in wastewater treatment application and sustainable waste management of harvested aquatic macrophytes were reviewed. Finally, the present study explicates the future perspectives of phytoremediation. Based on the reviews, it can be concluded that green chemistry characteristics of phytoremediation in nitrogen have proved that it is sustainable and cost-effective in relation to other existing ammoniacal nitrogen remediation technologies. Therefore, it can be deduced that a cheaper and more environmental friendly ammoniacal nitrogen technology can be achieved with the utilization of phytoremediation in wastewater treatment.

1. Introduction

Ammoniacal nitrogen is one of the wastewater contaminants, which can be found in many types of wastewater. Excessive ammoniacal nitrogen in water body may lead to eutrophication, which induces the growth and decay of excessive plant and algal, and caused degradation of the water quality [1]. Notably, algal blooms may limit light penetration. On the other hand, eutrophication promotes anoxia in the water body, which leads to unpleasant and injurious gases, and endangers fish and invertebrates [1]. To date, there are several current methods being employed for the removal of ammoniacal nitrogen in wastewater. Ammoniacal nitrogen may be removed by means of conventional air stripping tower, which can only remove around 60% to 90% ammoniacal nitrogen. However, it should be noted that this process requires the use of chemicals for pH value control, therefore imposing higher

treatment cost and lime-related operating and maintenance problems. Apart from the conventional air stripping tower, ammoniacal nitrogen can also be removed with break-point chlorination. This process is able to remove 90% to 100% of ammoniacal nitrogen, but it generates high chlorine residual and can be detrimental to the aquatic life. In addition, it requires careful control of the pH value in order to prevent the formation of nitrogen trichloride gas.

To date, phytoremediation is regarded as one of the most economically viable, sustainable, and affordable technologies. This is due to the fact that plants-based systems and microbiological processes were utilized in phytoremediation to reduce pollutants in nature [2]. It is an in situ remediation technology, which is ecologically friendly and solar dependent clean-up technology [2]. It is noteworthy that phytoremediation is a green chemistry process which offers a sustainable alternative and cost-effective technology